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ABSTRACT

This document is specifically an aid for teachers of handicapped children, providing information concerning the purchase of instructional materials. Many materials specifically designed for handicapped children are equally appropriate for young children without handicaps because a sensory modality is incorporated in the design. For a material to be appropriate for a child, it must be suitable to his developmental level and specific handicap. Various factors to be considered when selecting appropriate materials are sensory dimensions, physical structure, cost, and content configuration. A teacher must be cognizant of the skill levels and motor responses required for use of the material. Manipulative devices are considered desirable because they offer first-hand experiences which enhance a child's learning. Cost consideration is not restricted to price alone. A teacher must estimate the cost in time needed to use a material effectively, and consider the material's durability. (Author/AJ)

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Removing the Blinders--

A Shopper's Guide to Instructional Materials*

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What information does a shopper need to determine whether or not to buy a head of lettuce, and to determine which head of lettuce to buy? The shopper must first of all decide what he will use the lettuce for. In some cases only lettuce could be used; in others an alternative such as cabbage might be appropriate. Heads of lettuce can be compared as to weight, color and price, but is impossible to know how the lettuce will taste before using it.

So it is with instructional materials. Teachers are faced with the task of selecting materials, but it is difficult to be a knowledgeable consumer. The teacher who acquires instructional materials without reliable information is like the grocery shopper who is blindfolded. Many factors must be considered, but information about these factors is seldom available.

Manufacturers' catalogs can be acquired, but it would certainly be an inefficient use of a teacher's time to compare all the descriptions of the materials. Even assuming that the information is accurate and relevant, it is impossible to discern from a picture or description the physical nature or the effectiveness of the material. The teacher needs the opportunity to examine and evaluate the available materials before considering them for purchase.

The process of decision-making is a vital one if one accepts the point of view that much of a child's learning is achieved through the manipulation of instructional materials. Inappropriate and inadequate materials and equipment can limit the effectiveness of learning. Although good instruction is not dependent on good materials, they can enhance learning.

One function of the Special Education Instructional Materials Center/Regional Media Center Network[1] is to help teachers of handicapped students to be knowledgeable consumers. The examination of approximately

70 manipulative devices related to mathematics for young children brought out several important areas which are helpful to consider when selecting materials. The SEIMC specifically serves teachers in special education, but we believe that information about materials is not limited in relevance to any one area of speciality. For a material to be appropriate for a child, it must be suitable to the child's developmental level and specific handicapping conditions. An older child with a handicap may function at a maturational level of a younger child; materials must be chosen for him with this observation in mind. A material developed for a specific handicapping condition may be just the thing for a younger child as well. These factors will be considered more specifically in the following discussion.

SENSORY DIMENSIONS

To determine whether or not a material is appropriate, it is necessary to consider which of a child's senses, and what skill level, are required for use of the material. What tasks are inherent in the use of the material; what form of response must a child make in order to learn from a material and to demonstrate his learning? Must he be able to see, to speak, or to write?

If a motoric response is required, it is important to break down the skill or skills involved. Does manipulation of a material require fine or gross coordination in a thumb and finger grasp? A puzzle with small knobs would have to be picked up with the juxtaposition of the thumb and one finger (fine), while the grasping of wooden cubes would involve the use of the thumb and two or more fingers (gross). Considering finger use, a simple cash register requires the use of an individual finger or thumb, while the stretching of rubber bands on a geo-board demands coordinated use of several fingers.

Use of the arms is called for at three different levels; tracing movement is used in the touching of tactile number cards; a clock must be stabilized with one hand while the other manipulates the moving parts; playing an instrument might require the use of two hands performing separate functions. A walk-on-number line would obviously involve the use of the leg or foot. The category of eye-hand coordination suggests that different materials require the ability to place the arm in a broad unconfined area (domino plaques or graduated blocks) while others demand increasingly more refined physical development to place an object in a confined area (puzzle or peg board).

These categories may facilitate the individualizing of a curriculum according to a specific handicapping condition as well as to maturational levels. A teacher of an older cerebral palsy child with poor arm coordination and a teacher of 2-3 year olds may both look for materials having large knobs or handles which do not necessitate fine prehensile control.

Many materials which are specifically designed for children with a handicap are equally appropriate for young children without handicaps because a sensory modality is incorporated in the design. Domino plaques with beaded or sanded dots enable a blind child to interact with a material; the tactile dimension, however, is equally suitable to the learning style of a young seeing child. All children need experiences in tactile discrimination as a foundation for the more abstract task of visual discrimination (painted dots).

Teachers, knowing their children's skills, are in the best position to adapt materials to their children's needs and to influence the manufacturing of materials. For instance, an apparatus which must be held with one hand while working with the other is certainly not out of the question for a child who has strength in only one arm. The teacher can secure the material with

a clamp or provide for the assistance of another child. One distributor[2] is even manufacturing adaptations that teachers have suggested based on classroom experiences (rounded-concave counting chips that are easier to pick up that flat ones; metal clips that prevent weights from falling off a pegged math balance).

STRUCTURE

It is known that children learn a great deal through acting on a material. Manipulative devices are considered desirable because they offer first hand experiences which enhance a child's learning.

No evidence exists which suggests that a child learns merely by manipulating a material. The material must be organized or structured in such a way that a child learns through manipulating. It is important to examine an item to determine how it is structured. The design of a material suggests the style of teacher-child interaction. A material which embodies a fundamental concept in concrete form and is self-correcting facilitates a child's independent discovery through manipulation of the material. In the process of using a Stern counting board, for example, a child is dealing, in a self-directed way, with basic concepts, particularly the relationship between ordinal and cardinal numbers. Other items, such as a clock, may require the teacher to structure the learning so as to bring out and clarify the basic concepts of time.

Other questions arise. Is it constructed in such a way to clarify the concepts claimed by the producer? Is the material better used for another purpose? A material can conceivably be utilized at different levels of conceptual development, but it is important to determine the most appropriate level. Is the material most appropriate for a level of preliminary exploration

in which the child experiments in a random fashion? The best purpose may suggest a more directed activity, in which the concepts to be learned are structured by the material itself or by the teacher. Perhaps the material is best used for practice, when repetition reinforces learning through applied use of the concept.

Two examples of structured materials may be illustrative. What does a child learn about the concept of squareness from a material which provides two rectangles and two squares as components of a 3-D structure? The final product looks like a polygon with four equal sides, but the child manipulates pieces of unequal dimensions.

Secondly, is the relationship between the numeral 4 and a set of four items best introduced by a material which provides four pictures on one block of wood to be matched to the appropriate numeral? It is necessary to consider the skills involved. The child must visually discriminate four pictures, but he actually handles only one item--the block. This task would be more appropriate after the child has had many tactile experiences handling and sorting four separate items.

One helpful guide for sorting through the diversity of apparatus is to consider the approaches to the teaching of number concepts that the material represents. Materials reflect differing views on the type of actions which should be encouraged to help the child understand the relationships inherent in the number system.

One approach is concerned with providing experiences in counting, i.e., in helping the child answer the question "How many?". This process requires that the child know 1) a set of words ("one," "two," "three") which are 2) used in a standard order and 3) matched individually with each item in a group.

Materials such as beads, counters, and bead bars are designed to give children this opportunity to work with collections of items which can be handled individually. They promote the counting of individual units and the matching of each unit with the series of numerical symbols. Through activities in sorting, matching and ordering, a child may come to think of a number as representing both a group of items (4) and a position in a series (4th). These concepts are basic to arithmetical operations. In the addition of 5 plus 1, a child must be able to think of 5 as a group to which he adds 1 more, without having to recount 1, 2, 3, 4, 5 each time. He needs to realize as well that the 6th in a series follows a group of five.

These concepts grow out of a variety of experiences in grouping and counting (establishing a one-to-one correspondence between objects and number words). Aids such as dominoes and pattern cards offer set patterns which give the child practice in recognizing different groupings as he comes to abstract the idea of "fiveness," for example, in a variety of visual formations.

Another approach emphasizes measurement rather than counting. Materials developed by Cuisinaire and Stern are based on the concept that counting of discrete objects and grouping into different patterns does not foster thinking of numbers in relationship to each other. An appreciation of the number system is structured in the use of number lengths which represent numerical size by physical size. Instead of matching individual objects with number names to find out how many in one group, then another, a child matches number lengths to answer the question "How much?". The lengths are designed as multiples of basic units, such as the cube, so that the numerical property of a length can be easily seen when visually compared with another. The equivalence of two lengths can be judged at a glance without counting the individual units.

There are arguments to be made in support of each approach,[3] basically suggesting that measurement fosters relational thinking, while counting enables a child to apply arithmetic skills to a variety of everyday situations. Both approaches undoubtedly have their place in a math program; when choosing materials a teacher needs to be aware of the processes involved so that the materials will, in fact, reinforce the desired concept.

COST

The price of a material is an obvious consideration, but is price the only cost involved? Besides money, the major cost to the teacher is the time that must be invested to use a material effectively. The decision to purchase rather than make an item may be wisely based on an estimate of the personal energy and time required to construct a material, balanced with the money spent. The same thinking might just as well lead to the conclusion that it is worth the effort to make it oneself.

Components of an instructional system, such as Montessori, Stern or Dienes, demand special consideration, for effective use of the materials requires that the teacher absorb the philosophy and conceptual framework formulated by the originator. A system consists of a presentation of more than one concept, either by a logical progression of more than one material or by a logical progression of tasks with the same material. The integrity and consistency of the approach is sacrificed when a component is not used in the context of underlying ideas of the system, i.e., how children learn and what is an appropriate teaching style. A teacher, therefore, needs to anticipate the investment of her time and judge her compatibility with the approach.

Also important is the relationship between the expected life span of a material and the durability of the packaging. The cost of an item is not

necessarily an accurate index of durability, for many expensive kits are sold in shoddy packaging. On the other hand, elaborate, strong packaging may house relatively inexpensive, consumable component parts, such as cardboard shapes which curl at the edges when dampened by young nands. Kits may be convenient, but the knowledgeable consumer will examine the components and weigh their durability against the cost of the whole kit. It is helpful to know whether or not replacement parts are available. Storage may be another factor. Are the components easily stored in the package and readily accessible to the children, or must the teacher store items separately?

In selecting items, a teacher may consider the inexpensive item, such as cardboard domino cards, a poor investment; more durable masonite sets may be more practical and cheaper in the long run. They will not break and curl at the edges, and are available in wooden storage boxes which withstand consistent usage. But even these boxes aren't indestructible, for they may crack when dropped.

Materials which seem durable may be undesirable. Wood is a sturdy material, but it may form an inappropriately expensive base for decals which are poorly secured with tape or clear contact. Metal frames of a shape-matching material which lack a reinforced felt backing may warp, making it difficult or impossible to insert the matching shape. Felt backing may also be vital for muffling the sharp clang of metal and softening the sharp, metal edges.

CONTENT: CONFIGURATION

An awareness of some inconsistencies in the content of materials may eliminate sources of confusion for children. The configuration of numerals and of patterns representing sets is one area that needs to be clarified.

A sample of materials will reveal different styles of symbols to

represent each of the numerals 4, 6, 9. Four is seen as 4, 4, and 4. The latter is typical of foreign materials which are available in the U. S. While most children are taught to print a 4, the symbol 4 is used in both printed and manipulative materials. Children need to be familiar with all three symbols for the concept of four; confusion may arise, however, if the distinctions are not brought out. Tactile numerals with the European four may only confuse a child who is struggling to print an open four. Consistency may be especially important for a child with perceptual problems.

Six and nine present similar difficulties. In many manipulative materials, six and nine are shaped as inversions, with curved stems, the six being an upside-down nine and vice versa (as print materials). In learning to write a nine, however, the child is taught to use a straight stem, rather than a curved one. Can it be helpful to offer tactile aids which do not match the style the child learns to print?

The concern over five involves too little variety, for almost every item uses the traditional domino pattern ⁘ to represent a set of five. A child who is only introduced to this pattern is likely to form an image of five in this way. Being aware of this, a teacher can provide materials that offer a variety of visual patterns through commercially manufactured or teacher-made materials.

CONCLUSION:

The factors discussed here are only a sample of the types of considerations that may assist a teacher in the process of deciding which materials are appropriate and adequate for the achievement of his objectives. Such information is necessary for the comparison of products on the market as well as for the development of teacher-made materials.

References and Notes

1. A project sponsored by the U. S. Office of Education, Bureau for the Education of the Handicapped

2. Selective Educational Equipment (SEE), 3 Bridge Street, Newton, Massachusetts 02195

3. J. D. Williams, "Teaching Arithmetic by Concrete Analogy-III. Issues and Arguments," EDUCATIONAL RESEARCH 5 (February 1963): 120-131.